

## CONSTRUCTION SPECIFICATION

## 410. GRADE STABILIZATION STRUCTURE

This specification is appropriate to grade stabilization structures within the scope of the standard for Practice 410.

**1. SITE PREPARATION**

All trees, brush, stumps, obstructions, and other objectionable material shall be removed and disposed of so as not to interfere with the proper construction and function of the structure.

**2. EARTHFILL****A. Material**

The fill material shall be taken from approved borrow areas. It shall be free of roots, stumps, wood, rubbish, oversized stones, and frozen or other objectionable materials. The embankment shall be constructed to an elevation which provides for anticipated settlement to the design elevation. The fill height all along the length of the embankment shall be increased above the design elevation as shown on the plans.

(1)

**B. Placement**

Areas on which fill is to be placed shall be scarified prior to placement of fill. Fill materials shall be placed in .8-inch maximum thickness (before compaction) layers which are to be continuous over the entire length of the fill. The most porous borrow material shall be placed in the downstream portions of the embankment.

**C. Compaction**

Compaction of each lift shall be achieved by a minimum of four complete passes of a sheepsfoot, rubber-tired or vibratory roller, or by routing the hauling and spreading equipment over the fill so that the entire surface of each lift shall be traversed by not less than one tread track of the equipment. Fill material shall contain sufficient moisture such that the required degree of compaction can be obtained with the equipment used.

**D. Cutoff Trench**

Where specified, a cutoff trench shall be excavated along or parallel to the centerline of the embankment as shown on the plans. The bottom width of the trench shall be governed by the

equipment used for excavation, with the minimum width being four feet. The depth shall be at least four feet or as shown on the plans. The side slopes of the trench shall be 1 to 1 or flatter. The backfill material for the cutoff trench shall be the most impervious material available and shall be compacted with equipment or rollers to assure maximum density and minimum permeability.

### 3. STRUCTURAL BACKFILL

Backfill material shall be of the type and quality conforming to that specified for the adjoining fill material. The fill shall be placed in horizontal layers not to exceed four inches in thickness and compacted by hand tampers or other compaction equipment. The material needs to fill completely all spaces under and adjacent to the pipe. At no time during the backfilling operation shall driven equipment be allowed to operate closer than four feet, measured horizontally, to any part of a structure. Under no circumstances shall the Contractor drive equipment over any part of a concrete structure or pipe unless there is a compacted fill of two feet or greater over the structure or pipe.

### 4. PIPE CONDUITS

#### A. Materials

##### 1. Corrugated Metal Pipe

- a. Steel pipe and its appurtenances shall be galvanized and fully bituminous-coated and shall conform to the requirements of AASHTO Specification H-190, Type A, with watertight coupling bands. Any bituminous coating damaged or otherwise removed shall be replaced with cold applied bituminous coating compound.
- b. Aluminized steel pipe and its appurtenances shall conform to the requirements of AASHTO Specification M-274-791 with watertight coupling bands. Coupling bands, anti-seep collars, end sections, etc. must be composed of the same material as the pipe. Metals must be insulated from dissimilar materials with the use of rubber or plastic insulating materials at least 24 mils in thickness. Aluminum surfaces that are to be in contact with concrete shall be painted with one coat of zinc chromate primer. Hot-dip, galvanized bolts may be used for connections. The pH of the surrounding soils shall be less than nine and greater than four.

- c. Helically corrugated pipe, in addition to the requirements above, shall have either continuously welded seams or have lock seams which are caulked, during fabrication, neoprene bead.
2. For pipes of other materials, specific specifications shall be shown on the drawings.
3. Other details (anti-seep collars, valves, etc.) shall be as shown on the drawings.

B. Connections

All connections with pipes must be completely watertight. The drain pipe or barrel connection to the riser shall be welded all around when the pipe and riser are metal. Watertight coupling bands shall be used at all joints. Anti-seep collars shall be connected to the pipe in such a manner as to be completely watertight.

C. Bedding

The pipe shall be firm and uniformly bedded throughout its entire length. Where rock or soft, spongy or other unstable soil is encountered, all such material shall be removed and replaced with suitable earth compacted to provide adequate support.

D. Laying pipe

The pipe shall be placed with inside circumferential laps pointing downstream and with the longitudinal laps at the sides.

E. Backfilling

Backfilling shall conform to structural backfill as shown above.

5. **CONCRETE**

A. Materials

1. Cement -Portland cement shall conform to the latest ASTM Specification C-150.
2. Water -The water used in concrete shall be clean, free from oil, acid, alkali, scales, organic matter or other objectionable substances.

3. Sand -The sand used in concrete shall be clean, hard, strong and durable, and shall be well graded with 100 percent passing a one-quarter inch sieve. Limestone sand shall not be used.
  4. Coarse Aggregate -The coarse aggregate shall be clean, hard, strong and durable, and free from clay or dirt. It shall be well graded with a maximum size of one and one-half (1-1/2) inches.
  5. Reinforcing steel -The reinforcing steel shall be deformed bars of intermediate grade billet steel or rail steel conforming to ASTH Specification A-615.
- B. Design Mix -The concrete shall be mixed in the following proportions, measured by weight. The water-cement ratio shall be 5-1/2 to 6 U.S. gallons of water per 94-pound bag of cement. The proportion of materials for the trial mix shall be 1:2:3-1/2. The combination of aggregates may be adjusted to produce a plastic and workable mix that will not produce harshness in placing or honeycombing in the structure. Admixtures may be used, when approved, in accordance with the manufacturer's recommendations.
- C. Mixing -The concrete ingredients shall be mixed in batch mixers until the mixture is homogeneous and of uniform consistency. The mixing of each batch shall continue for not less than one and one-half minutes after all the ingredients, except the full amount of water, are in the mixer. The minimum mixing time shall be based on proper control of the speed of rotation of the mixer and of the introduction of the materials, including water, into the mixer. Water shall be added prior to, during, and following the mixer-charging operations. Excessive overmixing requiring the addition of water to preserve the required concrete consistency shall not be permitted. Truck mixing will be allowed provided that the use of this method shall cause no violation of any applicable provisions of the specifications given here.
- D. Forms -The forms shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping, and vibration without deflection from the prescribed lines. They shall be mortar-tight and constructed so that they can be removed without hammering or prying against the concrete.

The inside of forms shall be oiled with a non-staining mineral oil or thoroughly wetted immediately before concrete is placed.

Forms may be removed 24 hours after the placement of concrete. All wire ties and other devices used shall be recessed from the surface of the concrete.

- E. Reinforcing Steel -All reinforcing material shall be free of dirt, rust, scale, oil, paint or any other coatings. The steel shall be accurately placed and securely tied and blocked into position so that no movement of the steel will occur during placement of concrete.
- F. Consolidating: - Concrete shall be consolidated with internal-type mechanical vibrators. Vibrations shall be supplemented by spading and hand tamping as necessary to ensure smooth and dense concrete along form surfaces, in corners, and around embedded items.
- G. Finishing -Defective concrete, honeycombed areas, voids left by the removal of tie rods, ridges on all concrete surfaces permanently exposed to view or exposed to water on the finished structure, shall be repaired immediately after the removal of forms. All voids shall be reamed and completely filled with dry-patching mortar.
- H. Curing -Concrete shall be prevented from drying for at least seven days after it is placed. Exposed surfaces shall be kept continuously moist during this period by covering with moistened canvas, burlap straw, sand or, other approved material unless they are sprayed with a curing compound. Wooden forms left in place during the curing period shall be kept wet.

Concrete, except at construction joints, may be coated with a curing compound in lieu of continuous application of moisture. The compound shall be sprayed on moist concrete surfaces as soon as free water has disappeared but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. Curing compound shall not be allowed on any rebars. Curing compound shall be applied in a uniform layer over all surfaces requiring protection at a rate of not less than one gallon per 150 square feet of surface. Surfaces subjected to heavy rainfall or running water within three hours after the curing compound has been applied shall be resprayed. Any construction activity which disturbs the curing material shall be avoided during the curing period. If the curing material is subsequently disturbed, it shall be reapplied immediately.

Steel tying or form construction adjacent to new concrete shall not be started until the concrete has cured at least 24 hours. Vehicles, overlaying structures, or other heavy loads shall not be placed on new concrete slabs for at

least three days, unless the concrete strength can be shown to be adequate to support such loads.

- I. Concreting in Cold Weather -Concreting in cold weather shall be performed in accordance with ACI 306, of which some specific interpretations are set forth below.

Concrete shall not be mixed nor placed when the daily atmospheric temperature is less than 40 degrees Fahrenheit unless facilities are provided to prevent the concrete from freezing. The use of accelerators or anti-freeze compounds will not be permitted. The temperature of the concrete at the time of placement shall not be less than 50 degrees Fahrenheit and shall be maintained at temperatures not less than 40 degrees Fahrenheit for a period of seven days.

Concrete placement will not be permitted between December 1 and March 15 unless procedures for cold weather concreting are provided. Such procedures shall be set forth in a written plan by the Contractor and shall include, but are not limited to:

1. Use of warm concrete (but less than 90 degrees Fahrenheit).
2. Adequate protection from the weather including the use of artificial heat - to maintain the temperature of the concrete and adjacent air between 40 degrees Fahrenheit and 90 degrees Fahrenheit for a period of seven days.

Regardless of cold weather procedure, concrete placement will not be permitted when the air temperature during the placement and the following 24 hours is predicted to fall below 32 degrees Fahrenheit.

- J. Concreting in Hot Weather -Concrete in hot weather shall be performed in accordance with ACI 305, of which some specific interpretations are set forth below.

The supplier shall apply effective means to maintain the temperature of concrete below 90 degrees Fahrenheit during mixing and conveying. Exposed surface shall be continuously moistened by means of fog spray or otherwise protected from drying during the time between placement and finishing and during curing. Concrete with a temperature above 90 degrees Fahrenheit shall not be placed.

- K. Backfilling New Concrete Walls - Backfilling and compaction adjacent to new concrete walls shall not begin in less than 14 days after placement of the concrete, except walls that

are to be backfilled on both sides simultaneously may be done after seven days.

Heavy equipment shall not be allowed within four feet of new concrete walls. Provide compaction near the wall by means of hand tamping or small, manually-directed equipment.

## 6. STABILIZATION

All borrow areas shall be graded to provide proper drainage and left in a sightly condition. All exposed surfaces of the embankment, spillway, spoil and borrow areas, and berms shall be stabilized by seeding, fertilizing and mulching (if required) in accordance with the vegetative treatment specifications shown on or accompanying the drawings.